City of Salina Raw Water Supply Study

Citizen's Advisory Board Workshop

February 12, 2009
6:00 PM

Introductions

- City Staff
  - Martha Tasker, Director of Utilities
  - Kurt Williams, Plant Operations Manager
  - Jeff Cart, Utilities Supervisor
  - Steve Palmer, Utility Engineer
- Consultants
  - HDR
    - Donald Lindeman, Project Manager
    - Lorrie Hill, Project Engineer
  - Wilson & Company
    - Jason Schlickbernd, Asst. Project Manager
  - Layne Christensen
    - Luca DeAngelis Hydrogeologist

Questions?
Contact: **Martha Tasker**
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E-Mail: **martha.tasker@salina.org**

Introductions

- Citizens Advisory Board Members

Dan Ade
Todd Anderson
Gina Bell
Robert Bostater
Beth Eisenbraun
Tim Hobson
Mike Hulteen
Brian Kinnaird
James Maes
Charles May
John Ourada
Lawrence Wetter

Agenda for Tonight

- Review of Study Objectives
  - Purpose of Citizens Advisory Board
  - Scope of the Raw Water Supply Study
- Alternatives Process
- Preliminary Screening of Alternatives
- Alternatives Evaluation Criteria

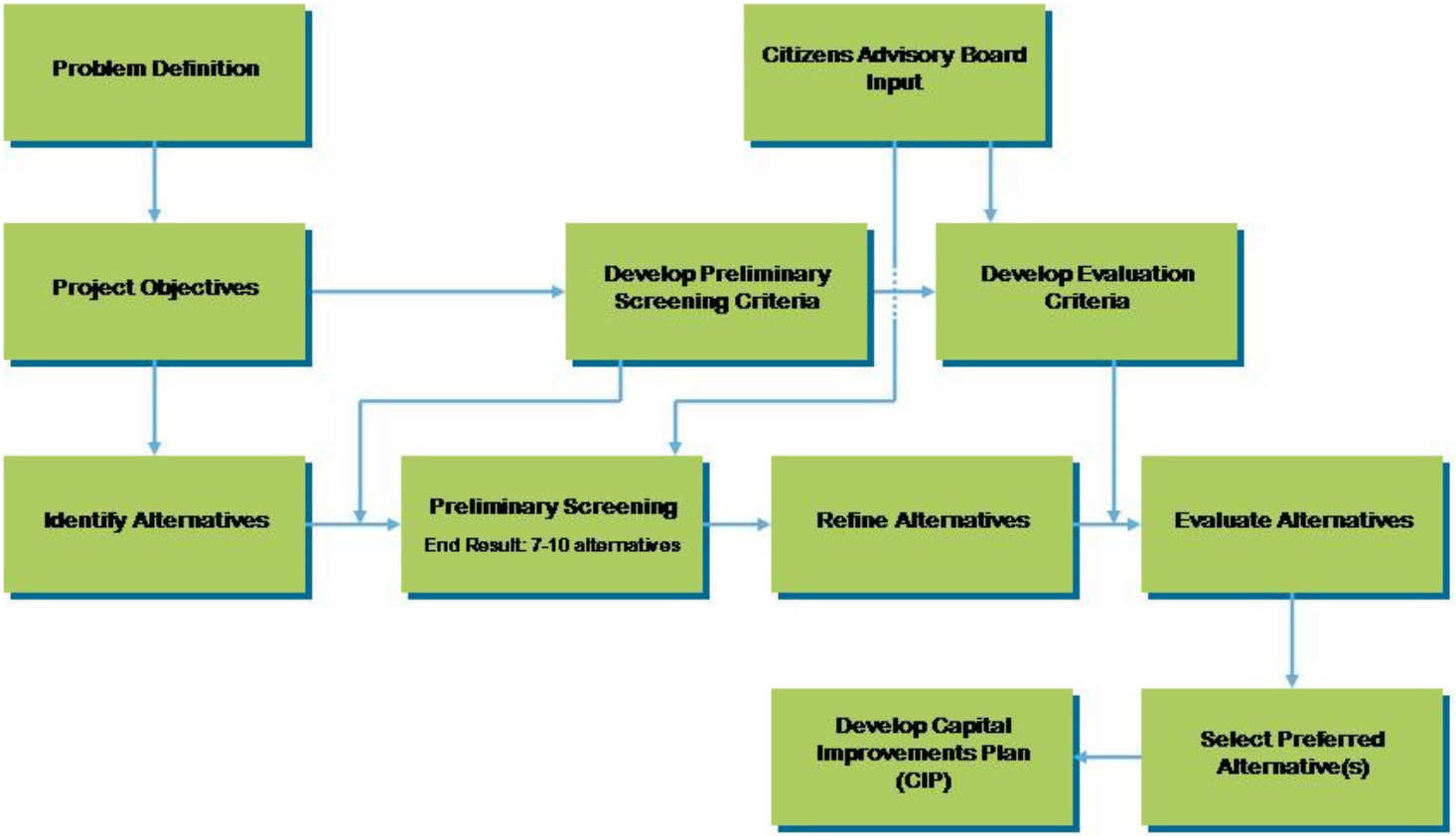
Raw Water Supply Study

- Purpose of Study
  - Recent drought conditions
  - Contamination issues near wellfields
  - Strained ability of City to maintain adequate water supply for customers
  - Identify sustainable solutions for next 50 years
  - Diversify water supply sources
- CAB meetings at key project milestones
  - August, 2008 - Demand projections, water rights
  - November, 2008 – Future regulatory impacts, existing facilities
  - December, 2008 - Conservation, reuse
  - January, 2009 – New Sources of Supply
  - February, 2009 – Alternatives
  - March, 2009 – Draft Report

Alternatives Process

Alternatives Process

- Systematic way to evaluate potential alternatives



Problem Definition/Project Objectives

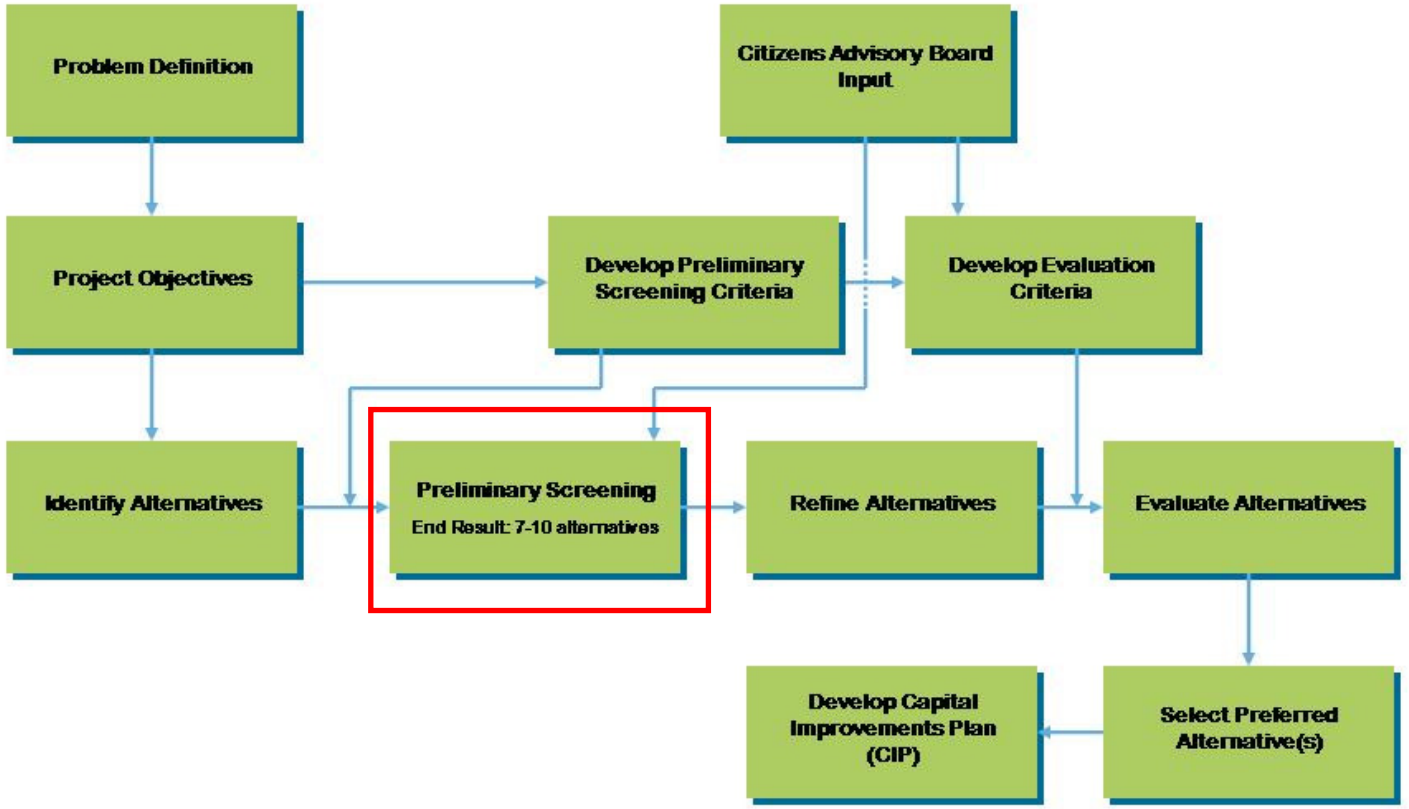
- Problem Definition
  - Decreased reliability of raw water supplies during drought conditions
  - Contamination issues with existing wells
  - Need water supplies to meet growing demands
- Project Objectives
  - Increase the reliability of raw water supplies, especially during drought conditions
  - Support economic growth and development
  - Optimize existing infrastructure where possible
  - Minimize risks to the City and its customers
  - Cost effective solutions – “most bang for the buck”

Identification of Alternatives

1) Improvements at Downtown Wellfield
2) Improvements at South Wellfield
3) Seasonal surface water right
4) Kanopolis Reservoir
5) Milford Reservoir
6) Wilson Reservoir
7) Saline River
8) Confluence of Smoky Hill Solomon Rivers
9) Dakota Aquifer
10) Construct a reservoir
11) Acquire existing water rights
12) Water Assurance District
13) Aquifer recharge
    - Infiltration ponds
    - Direct recharge wells
    - Infiltration through oxbow
    - Aquifer storage and recovery system
    - Water reuse for groundwater recharge
14) Water reuse
    - All irrigation + industrial sites
    - All irrigation sites
    - City-owned irrigation sites

Preliminary Screening of Alternatives

Preliminary Screening of Alternatives



Preliminary Screening Criteria

- Related to the project objectives
- Five general criteria:
  - Optimizes existing resources
    - Includes water rights, raw water infrastructure, treatment infrastructure
  - Increases reliability during drought
    - Includes increased reliability of existing sources and new sources that are independent of existing sources
  - Minimizes implementation risk
    - Includes effectiveness of alternative, public issues, historical use for water supply, permitting, approval, and development processes
  - Expandable for future demands
    - Includes availability for future water rights, physically expandable
  - Cost effective
    - Most bang for the buck
    - Based on unit cost
    - Capital costs only – does not include O&M costs
      - 30% contingencies for unknown work
      - 20% factor for engineering, legal, etc

Preliminary Screening Information (cont)

- Improvements at Downtown Wellfield
  - Criterion 1: Optimizes existing resources - PASS
    - Re-drill 5 wells, treat contamination, upsize air strippers to maximize existing water right of 15.2 MGD
  - Criterion 2: Increases reliability during drought – PASS/FAIL
    - Same drought-prone source historically used by City
    - Partially increases reliability if all wells can be used
    - Reliability may be further increased with passive/direct recharge
  - Criterion 3: Minimizes implementation risk - PASS
    - Minimal risk since it has historically been used by City
  - Criterion 4: Expandable for future demands - FAIL
    - Area closed to further appropriations – cannot drill more wells
  - Criterion 5: Cost effective
    - Total cost - $6.4 million
    - Cost/gallon - $2.13/gallon (based on 3 MGD)

Preliminary Screening Information (cont)

- Improvements at South Wellfield
  - Criterion 1: Optimizes existing resources - PASS
    - Re-drill 2 wells to maximize existing water right of 3.7 MGD
    - Construct treatment plant to reduce iron/manganese/hardness
  - Criterion 2: Increases reliability during drought - PASS
    - Considered an additional source to increase reliability
    - Well spacing increases reliability compared to Downtown Wellfield and groundwater not over-developed
  - Criterion 3: Minimizes implementation risk - PASS
    - Conventional treatment capable of treating iron, manganese, and hardness with minimal permitting risk
  - Criterion 4: Expandable for future demands - PASS
    - May be able to obtain additional water rights or acquire existing water rights
  - Criterion 5: Cost effective
    - Total cost - $15.2 million
    - Cost/gallon - $4.10/gallon (based on 3.7 MGD)

Preliminary Screening Information (cont)

- Seasonal Water Right on Smoky Hill River
  - Criterion 1: Optimizes existing resources - PASS
    - Use to meet demands during October - June
    - Optimizes wellfields and existing Smoky Hill River water right so that they can be used during times of peak usage
    - Need a new intake, pump station, and treatment for taste & odor
  - Criterion 2: Increases reliability during drought – PASS/FAIL
    - Preserves aquifer levels and surface water right for peak usage
    - May be times when cannot use seasonal right due to low flows
  - Criterion 3: Minimizes implementation risk - PASS
    - Smoky Hill River already used as a source
  - Criterion 4: Expandable for future demands - PASS
    - May be able to obtain additional seasonal water rights
  - Criterion 5: Cost effective
    - Total cost - $5.1 million
    - Cost/gallon - $0.51/gallon (based on 10 MGD)

Preliminary Screening Information (cont)

- Kanopolis Reservoir
  - Criterion 1: Optimizes existing resources - FAIL
    - Need an intake, pump station, and 27+ miles of pipeline
  - Criterion 2: Increases reliability during drought – PASS/FAIL
    - New source for City; decreased Smoky Hill River flows correspond with low levels in Kanopolis Reservoir
  - Criterion 3: Minimizes implementation risk - FAIL
    - Risk in ability to obtain storage in the reservoir – over-committed
  - Criterion 4: Expandable for future demands - FAIL
    - Safe yield of reservoir will decrease in future due to sedimentation
  - Criterion 5: Cost effective
    - Total cost - $14.0 million
    - Cost/gallon - $7.02/gallon (based on 2 MGD)
    - $113,000 in 2009 to purchase storage (annual cost)

Preliminary Screening Information (cont)

- Milford Reservoir
  - Criterion 1: Optimizes existing resources - FAIL
    - Need an intake, pump stations, and 45+ miles of pipeline
  - Criterion 2: Increases reliability during drought - PASS
    - New source for City; different river-basin than current sources
  - Criterion 3: Minimizes implementation risk - FAIL
    - Risk in ability to obtain storage in the reservoir – 75 MGD is allocated for future water supply but has not been opened up
    - Risk in potential inter-basin transfer requirements
  - Criterion 4: Expandable for future demands - PASS
    - 75 MGD of storage not currently opened up
  - Criterion 5: Cost effective
    - Total cost - $30.8 million
    - Cost/gallon - $6.16/gallon (based on 5 MGD)
    - $113,000 in 2009 to purchase storage (annual cost)

Preliminary Screening Information (cont)

- Wilson Reservoir
  - Criterion 1: Optimizes existing resources - FAIL
    - Need an intake, pump stations, and 55+ miles of pipeline, reverse osmosis treatment facility, disposal of concentrate
  - Criterion 2: Increases reliability during drought – PASS/FAIL
    - New source for City; decreased Smoky Hill River flows may correspond with low levels in Wilson Reservoir – same basin
  - Criterion 3: Minimizes implementation risk - FAIL
    - Has not been used as a water supply source
    - Risk in ability to obtain storage in the reservoir – no allocation for water supply
    - Risk in development and permitting of RO facility
  - Criterion 4: Expandable for future demands - PASS/FAIL
    - Possibly – depends if KWO purchases storage and how much they purchase
  - Criterion 5: Cost effective
    - Total cost - $70.5 million
    - Cost/gallon - $14.10/gallon (based on 5 MGD)
    - $113,000 in 2009 to purchase storage (annual cost)

Preliminary Screening Information (cont)

- Saline River
  - Criterion 1: Optimizes existing resources - FAIL
    - Need wells to withdraw, reverse osmosis treatment facility, disposal of concentrate, pump station, 5+ miles of pipeline
  - Criterion 2: Increases reliability during drought - PASS/FAIL
    - New source for City; decreased Smoky Hill River flows may correspond with low flows in Saline River – same basin
  - Criterion 3: Minimizes implementation risk - FAIL
    - Has not been used as a water supply source (municipal)
    - Risk in development and permitting of RO facility
  - Criterion 4: Expandable for future demands - PASS
    - Not over-developed with water rights
  - Criterion 5: Cost effective
    - Total cost - $41.3 million
    - Cost/gallon - $8.25/gallon (based on 5 MGD)

Preliminary Screening Information (cont)

- Confluence of Smoky Hill River and Solomon River
  - Criterion 1: Optimizes existing resources - FAIL
    - Need wells to withdraw, reverse osmosis treatment facility, disposal of concentrate, pump station, 13+ miles of pipeline
  - Criterion 2: Increases reliability during drought - PASS
    - New source for City; more flow in river near confluence during past droughts due to Saline River and Solomon River
  - Criterion 3: Minimizes implementation risk - PASS/FAIL
    - Currently used for municipal water supply
    - Risk in development and permitting of RO facility
  - Criterion 4: Expandable for future demands - PASS
    - Not over-developed with water rights
  - Criterion 5: Cost effective
    - Total cost - $46.4 million
    - Cost/gallon - $9.28/gallon (based on 5 MGD)

Preliminary Screening Information (cont)

- Dakota Aquifer
  - Criterion 1: Optimizes existing resources - FAIL
    - Low yield wells – need many of them (24 for 5 MGD @ 150 gpm per well)
    - Need wells to withdraw, pump stations, 30+ miles of pipeline (due to well spacing requirements – depends where in Dakota Aquifer)
  - Criterion 2: Increases reliability during drought - PASS
    - New source for City that is independent of drought-impacted sources
  - Criterion 3: Minimizes implementation risk - FAIL
    - Aquifer highly variable in yield and water quality
  - Criterion 4: Expandable for future demands - PASS
    - Not over-developed with water rights
  - Criterion 5: Cost effective
    - Total cost - $31.2 million
    - Cost/gallon - $6.24/gallon (based on 5 MGD)

Preliminary Screening Information (cont)

- Construct a Water Supply Reservoir
  - Criterion 1: Optimizes existing resources - FAIL
    - Assume can treat at existing WTP if surface water not in use
    - Need reservoir (25,000 AF), intake, pump station, 5+ miles of pipeline (depends on site)
  - Criterion 2: Increases reliability during drought - PASS
    - New source for City
  - Criterion 3: Minimizes implementation risk - FAIL
    - Risk in permitting and development of reservoir – long lead time
    - Risk with dam breaks/flooding and loss of life/property
  - Criterion 4: Expandable for future demands - PASS/FAIL
    - Design for planning horizon
    - Yield of reservoir will decrease in future due to sedimentation
  - Criterion 5: Cost effective
    - Total cost - $162 million
    - Cost/gallon - $32.48/gallon (based on 5 MGD)
    - Does not include costs for relocating roads and utilities, etc

Preliminary Screening Information (cont)

- Acquire Existing Water Rights
  - Criterion 1: Optimizes existing resources - FAIL
    - If acquire groundwater rights – need to re-drill wells
    - If acquire surface water rights – need to construct intake
  - Criterion 2: Increases reliability during drought - PASS/FAIL
    - Likely the same sources as existing sources
    - Water rights acquired would be spread out over aquifer and not as impacted by over-pumping
  - Criterion 3: Minimizes implementation risk - PASS
    - Normal permitting with DWR as long as don't move well over ½ mile
    - Willing sellers minimize risk
  - Criterion 4: Expandable for future demands - PASS
    - Could obtain additional water rights
  - Criterion 5: Cost effective
    - Total cost - $20.2 million
    - Cost/gallon - $4.05/gallon (based on 5 MGD)
    - Costs depend on how many water rights are acquired and location

Preliminary Screening Information (cont)

- Form a Water Assurance District (Kanopolis Reservoir)
  - Criterion 1: Optimizes existing resources - PASS
    - Use Smoky Hill River for conveyance and use existing intake
  - Criterion 2: Increases reliability during drought – PASS/FAIL
    - Would be a water supply source that is ensured to be available during droughts; Kanopolis may see low levels during a drought
    - Does not guarantee water purchased will make it to Salina (loss to aquifer)
  - Criterion 3: Minimizes implementation risk - FAIL
    - No storage in Kanopolis Reservoir allocated for Water Assurance District
    - Significant development time
  - Criterion 4: Expandable for future demands - FAIL
    - Yield of Kanopolis Reservoir will only decrease in the future due to sedimentation
  - Criterion 5: Cost effective
    - Costs vary by Water Assurance District, member, and reservoir
    - Must pay for storage even if don't use it that year
    - Only use the storage when needed

Preliminary Screening Information (cont)

- Aquifer Recharge
  - Existing infiltration ponds
  - Direct recharge wells - - Best Option for Water Supply
  - River oxbow
  - Criterion 1: Optimizes existing resources – PASS/FAIL
    - Temporarily increases aquifer levels to optimize existing wellfields
    - Need bank storage diversion wells or off-season water right as source
    - May not optimize wellfield during drought years if can't withdraw water
  - Criterion 2: Increases reliability during drought – PASS/FAIL
    - Increases aquifer levels for wellfields during a drought
    - During drought years may not be able to withdraw water for recharge
  - Criterion 3: Minimizes implementation risk - FAIL
    - Unknown if recharge will be effective due to alluvium/river interaction
    - Risk with permitting with DWR
  - Criterion 4: Expandable for future demands - FAIL
    - The aquifer can only be recharged so much
    - Wellfields can only be optimized so much
  - Criterion 5: Cost effective
    - Total cost - $7.8 million
    - Cost/gallon - $1.56/gallon (based on 5 MGD)

Preliminary Screening Information (cont)

- Water Reuse – 3 alternatives
  - All irrigation + industrial sites
  - All irrigation sites
  - City-owned irrigation sites (excluding Soccer Complex)
  - Criterion 1: Optimizes existing resources - PASS
    - Utilizes existing wastewater treatment infrastructure
    - Puts wastewater to beneficial use rather than discharging to river
    - Need additional treatment and pipeline
  - Criterion 2: Increases reliability during drought - FAIL
    - Does not save much from the municipal system (0.2 MGD – 0.6 MGD on average)
  - Criterion 3: Minimizes implementation risk – PASS/FAIL
    - Risk with public acceptance and effect of water quality on vegetation; however it has been done in Kansas successfully
  - Criterion 4: Expandable for future demands - PASS
    - Up to 3 MGD for consistent supply of reclaimed water
    - Minimum flow into wastewater treatment plant will increase as the City grows

Preliminary Screening Information (cont)

- Water Reuse – 3 alternatives (continued)
  - All irrigation + industrial sites
  - All irrigation sites
  - City-owned irrigation sites (excluding Soccer Complex)
  - Criterion 5: Cost effective
    - All irrigation + industrial sites
      - Total cost – $16.5 million
      - Cost per gallon – $27.00/gallon (based on 0.61 MGD saved from municipal water supply system)
    - All irrigation sites
      - Total cost – $11.6 million
      - Cost per gallon – $60.97/gallon (based on 0.19 MGD saved from municipal water supply system)
    - City-owned irrigation sites (excluding Soccer Complex)
      - Total cost – $5.7 million
      - Cost per gallon – $29.99/gallon (based on 0.19 MGD saved from municipal water supply system)

*Water reuse only viable if City obtains additional water rights or funded by private entity

Preliminary Screening Information (cont)

- Two alternatives not considered in preliminary screening
  - Aquifer storage and recovery (ASR) system
  - Water reuse for groundwater recharge
- Aquifer storage and recovery system:
  - Requires water to be stored in aquifer until City wants to use it
  - Water stored in alluvium will be discharged to the river within 9 months
- Water reuse for groundwater recharge
  - Wastewater requires additional treatment
  - Requires water to be stored in aquifer for extended periods of time for further treatment
  - Water stored in alluvium will be discharged to the river within 9 months

Preliminary Screening Information (cont)

- Summary of Costs

Alternative	Municipal Capacity (MGD)	Total Construction Cost	Other Costs	Total Project Costs	Cost/gal
Seasonal Water Right	10.00	$4,235,000	$847,000	$5,082,000	$0.51
Aquifer Recharge - Recharge Wells	5.00	$6,512,000	$1,302,000	$7,814,000	$1.56
Downtown Wellfield	3.00	$5,240,000	$1,048,000	$6,288,000	$2.10
Acquire Existing Water Rights	5.00	$16,857,000	$3,371,000	$20,228,000	$4.05
South Wellfield	3.70	$12,648,000	$2,530,000	$15,178,000	$4.10
Milford Reservoir	5.00	$25,649,000	$5,130,000	$30,779,000	$6.16
Dakota Aquifer	5.00	$26,008,000	$5,202,000	$31,210,000	$6.24
Kanopolis Reservor	2.00	$11,701,000	$2,340,000	$14,041,000	$7.02
Saline River	5.00	$34,381,000	$6,876,000	$41,257,000	$8.25
Confluence	5.00	$38,662,000	$7,732,000	$46,394,000	$9.28
Wilson Reservoir	5.00	$58,738,500	$11,748,000	$70,486,500	$14.10
Water Reuse all industrial + irrigation	0.61	$13,727,000	$2,745,000	$16,472,000	$27.00
Water Reuse City-owned irrigation	0.19	$4,913,000	$983,000	$5,698,000	$29.99
Reservoir Constuction	5.00	$135,350,800	$27,070,000	$162,420,800	$32.48
Water Reuse all irrigation	0.19	$9,653,000	$1,931,000	$11,584,000	$60.97

Natural Breakpoint

*Water Assurance District – costs unknown but assumed to be above the breakpoint line.
Only cost is annual cost to purchase the storage.

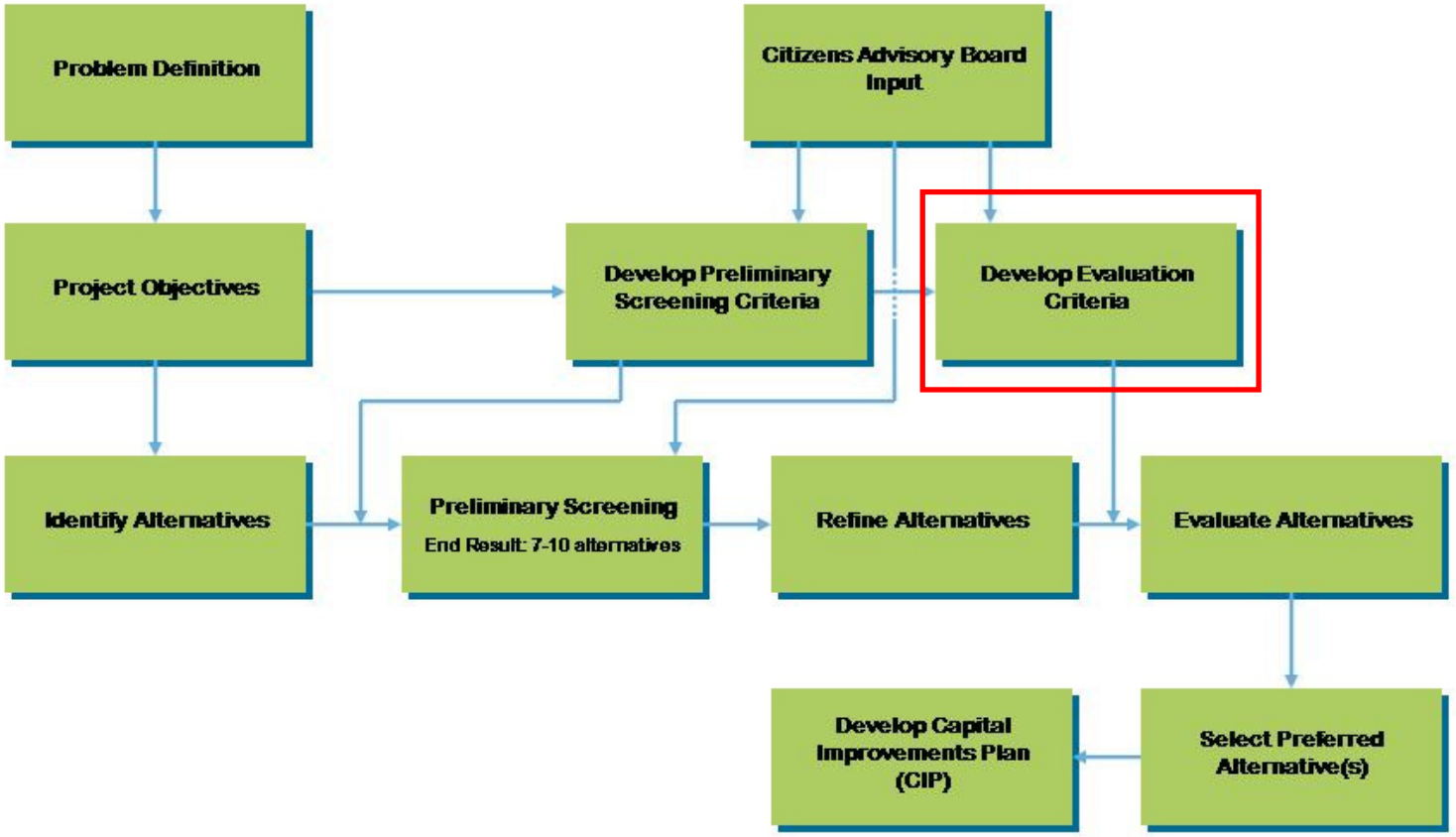
Preliminary Screening Results

Alternatives	Preliminary Screening Criteria - # Passing					Total # Passing Criteria
	Optimizes Existing Resources	Increases Reliability during Drought Periods	Minimizes Implementation Risk	Expandable for Future Demands	Cost Effective (above natural breakpoint)	
Improvements at South Wellfield	4				1	5
Obtain a seasonal surface water right	3.5				1	4.5
Improvements at Downtown Wellfield	2.5				1	3.5
Confluence of Smoky Hill and Solomon Rivers	2.5				1	3.5
Acquisition of existing water rights	2.5				1	3.5
Milford Reservoir	2				1	3
Dakota Aquifer	2				1	3
Water reuse	2.5				0	2.5
Saline River	1.5				1	2.5
Develop a water assurance district	1.5				1	2.5
Aquifer recharge	1				1	2
Kanopolis Reservoir	0.5				1	1.5
Construct a water supply reservoir	1.5				0	1.5
Wilson Reservoir	1				0	1

Note: Conservation is considered an integral part of the plan

Alternatives Evaluation Criteria

Alternatives Process



Evaluation Criteria

- More detailed than preliminary screening criteria
- What is important in comparing alternatives to one another?
  - Optimizes existing resources
  - Increases reliability during drought
  - Minimizes implementation risk (includes public acceptance)
  - Expandable for future demand
  - Cost effective
  - ~~Flexible for phased implementation~~
  - Minimizes environmental impacts
  - Desirable water quality
  - Permitability
  - Sustainability
  - **Time to Implement**

Discussion/Questions

Alternative Evaluation Process

CAB (Tonight)

- Each criteria will receive a weighting factor
  - CAB input tonight
  - Complete paired comparison matrix
  - Accounts for some criteria that are more important than others

PROJECT TEAM (Before next meeting)

- For each alternative
  - Assign 1, 2, or 3 for each criteria
  - 1 is low, 2 is moderate, 3 is high
  - Example – South Wellfield ranks high in optimizing existing infrastructure, so give it a 3

- Rank alternatives according to evaluation results
  - "Menu of Options"
- Develop capital improvements plan (CIP)
  - Identify short-term and long-term projects

Paired Comparison Matrix - Example

	Evaluation Criteria	1 Optimizes existing infrastructure	2 Increases reliability during drought	3 Minimizes implementation risk	4 Expandable for future demands	5 Cost Effective	6 Implementation Time	7 Minimizes environmental impacts	8 Desirable water quality	9 Permitability	10 Sustainability
1	Optimizes existing infrastructure		1 vs (2)	(1) vs 3	1 vs (4)	(1) vs 5	(1) vs 6	(1) vs 7	(1) vs 8	(1) vs 9	(1) vs 10
2	Increases reliability during drought			(2) vs 3	(2) vs 4	2 vs (5)	2 vs (6)	2 vs (7)	2 vs (8)	2 vs (9)	(2) vs 10
3	Minimizes implementation risk				3 vs (4)	(3) vs 5	(3) vs 6	(3) vs 7	(3) vs 8	(3) vs 9	3 vs (10)
4	Expandable for future demands					(4) vs 5	(4) vs 6	4 vs (7)	(4) vs 8	4 vs (9)	(4) vs 10
5	Cost effective						5 vs (6)	(5) vs 7	5 vs (8)	(5) vs 9	5 vs (10)
6	Implementation Time							6 vs (7)	(6) vs 8	6 vs (9)	(6) vs 10
7	Minimizes environmental impacts								(7) vs 8	(7) vs 9	7 vs (10)
8	Desirable water quality									8 vs (9)	8 vs (10)
9	Permitability										(9) vs 10
10	Sustainability										

How many times did you select:

1? 6

2? 4

3? 6

4? 6

5? 3

6? 4

7? 5

8? 2

9? 5

10? 5

Note: This matrix was completed at random for example purposes and does not reflect the views of the City or project team

Next CAB Meeting

- Thursday, March 19, 2009 – 6:00 PM
- Meeting Topics
  - Alternatives Evaluation Results
  - Capital Improvements Plan